ceived; and, if the people were to become homogeneous and the practice of exogamy continue, some expedient must have been devised by which the permanent groups could be maintained and kinship lines be defined. The common belief of the people, kept virile by the universal practice of the rite of the vision, furnished this expedient." "Social growth depended upon the establishment of distinct groups, and the one power adequate for the purpose was that which was believed to be capable of enforcing the union of the people by supernaturally inflicted penalties."

There were ten gentes in the Omaha tribe; exogamy prevailed, and descent was traced only through the father. "Each gens had its particular name, which referred directly or symbolically to its totem, which was kept in mind by the practice of tabu." The office of the totem in the religious societies, in the gentes, and the tribe is described, and the paper closes with a discussion of the linguistic evidence as to the import of the totem.

FRANK RUSSELL.

GENERAL BIOLOGY.

A Study in Heredity.[1] — For the student of heredity no domestic animal is of greater interest than the American trotting horse and his brother, the pacer. The two are closely related; their development has been rapid and has taken place mainly during the latter half of the present century, and the records of ancestry and of speed, which have been kept accurately, give a measure of the inheritance of variations in a large number of correlated parts. It is, therefore, a real service to biologists, as well, no doubt, to breeders, that Mr. A. J. Meston is doing in bringing together in one work the main facts concerning the ancestry of the best trotters and pacers.

The first part of this work, dealing with the descendants of the horse known as Rysdyk's Hambletonian 10, is what we have now under review. That the remaining parts will not be long forthcoming is to be hoped, for each part will gain in value in proportion to the completeness of the whole.

The pamphlet before us opens with a list of the common sources of 2:10 speed arranged chronologically. Then follows an introduc-

[1] A. J. Meston, *The Common Sources or Main Taproots of 2:10 Trotting and Pacing Speed. Rysdyk's Hambletonian 10 (Complete)*. Pittsfield, Mass. Published by the author, 1897. 32 pp.

tory chapter, containing, among other things, a very complete description of Hambletonian, with measurements and his pedigree. The main body of the work is a list of all the descendants of Hambletonian that have trotted or paced in 2:10 or lower. The date of birth, best record, and the date when it was made are given for each horse, and also the name of each ancestor in the Hambletonian line with dates and records. The whole is cleverly arranged, so that, with the aid of the index, the entire pedigree of each horse can be traced easily as far as this particular line of descent is concerned. Following the list are a note on the transmission of acquired speed, remarks on the dual inheritance of the capacities for trotting and pacing, and several interesting tables.

Hambletonian was the sire of 1287 colts. The American Trotting Register Association's *Year Book* for 1896, from which Mr. Meston has gathered a large part of his facts, credits Hambletonian with being the sire of 40 trotters (records 2:17½ to 2:30), 148 stallions that have sired 1398 trotters and 155 pacers, and 80 mares that have foaled 104 trotters and 8 pacers. "At the close of 1896 the *Year Books* have listed altogether 12,945 trotters that have made records in 2:30 or lower and 4302 standard pacers, — a grand total of 16,207 trotters and pacers with standard records."

"It is safe to say," the author remarks, "that somewhere between 80 and 90 per cent of the whole number 'carry the blood' of Hambletonian 10."

In view of these facts, the ancestry of Hambletonian is of great interest. His descent is traced through three lines, one paternal and two maternal, back three and four generations, to Messenger, an English thoroughbred imported to Philadelphia in 1788. This horse is remarkable because of the trotting instinct which almost invariably appeared in his half-bred foals, and which was strongly transmitted by his thoroughbred sons. Moreover, the paternal grandam and maternal grandsire of Hambletonian were natural trotters, not related to Messenger nor to one another. It is not surprising, therefore, that Hambletonian should be the founder of a race of trotters. There are also a large number of pacers among his descendants, and it is a significant fact that there were a few pacers among the foals of his sire, Abdallah 1.

The intensity with which the instincts for trotting and pacing and the capacity for speed have been transmitted through the descendants of Hambletonian is shown by the fact that of the 54 trotters and 146 pacers of all breeds who have made records of 2:10 or lower, 50

trotters and 122 pacers trace their descent in one or more lines from this horse. The preponderance of pacers is accounted for by the greater swiftness of their gait. Because of the inherently greater speed of the pace over the trot, it will be necessary, in order to compare the speed attained by a pacer with the speed of his trotting ancestors or brothers, to establish some ratio by which a trotting record may be transmuted to its equivalent pacing record, in the same way that Galton has transmuted female stature into its male equivalent in his discussions of the statistics of human measurements. This will require the comparison of a large number of individuals.

In the meantime, wishing to gain some idea of what this ratio may be, we have compared the 54 best pacers with the 54 2:10 trotters. Comparing each horse of one class with the horse of the corresponding grade in the other, there is found to be an average difference of 2⅓ seconds, the maximum being 3¾ seconds and the minimum 1¾ seconds. It is interesting to note in this connection that in the case of one horse in our list that has made fast records in both classes the difference is not more than the above maximum, the pacing record of Jay-Eye-See being 2:06¼, and his trotting record 2:10. If this difference represents the gain in speed which a horse equally gifted in both gaits would make in pacing, then all horses who can trot within 2:12½ should be classed with the 2:10 pacers. At any rate, it is unfair to compare 2:10 trotters with 2:10 pacers, and for this reason the tables on pages 27 and 28 are misleading.

The author points out another source of error which arises from the introduction of the bicycle sulky with pneumatic tires in 1892. But, allowing for errors due to bicycle sulkies, improved tracks, and more experienced trainers, we can see a gradual increase of trotting and pacing speed in successive generations. How much of this improvement is due to the inherited effects of training, and how much to selection and combination of favorable variations in breeding? The list shows that a number of stallions and mares, after having been trained to fast records, have got foals that have made fast records. But there is no evidence that a line of trained ancestors is more successful in producing speed than a line of untrained ancestors, or a line of mixed trained and untrained ancestors. For example, of the 122 pacers in the list only 8 have a parent or grandparent that has paced in 2:10 or trotted in 2:13. None of the 50 trotters has a parent with a 2:10 record. In the list of trotters both parents are given in 22 cases. Both parents have a record in only 2 cases; in 13 cases one parent only has a record; and in 7 cases neither

parent has a record. This list of 7 fast trotters whose parents have no record is headed by Alix (2:03¾), and if extended would include Maud S., St. Julien, and Goldsmith Maid.

With only the lines of descent that happen to be traceable to Hambletonian, we have not sufficient data for any very extensive generalizations. But what we have indicates that variations in speed and their inheritance follow the same laws that Galton [1] has shown to apply to stature, color, and other fortuitous variations in man and other organisms. A horse in the 2:10 class is, as a rule, the single exceptional son or daughter of comparatively mediocre parents of good family. The largest number from any one parent is six, foals of Altamont, who has a wagon record of 2:26¾. But Altamont is a grandson of Abdallah 15, who was the sire of Goldsmith Maid (2:14), and who counts among his descendants Alix (2:03¾), Flying Jib (2:04), and John R. Gentry (2:00½). The importance of heredity in the production of speed is indicated very clearly by an examination of the pedigrees. Thus, Alix (2:03¾) is descended not only from Abdallah 15, but also by two lines from Harold, a son of Hambletonian, who is the sire of Maud S. (2:08¾). John R. Gentry (2:00½) and Joe Patchen, who paced this season in 2:01½, have a common ancestor by separate lines in George Wilkes; and Nancy Hanks is a granddaughter of Dictator, the sire of Jay-Eye-See, who has paced in 2:06¼ and trotted in 2:10. The author expresses very strongly the opinion, which seems to be borne out by the facts, that the capacities for pacing and for trotting are heritages which, like the light and dark colors of the eye,[2] are, as a rule, mutually exclusive, and that the development of either of these, as well as the capacity for speed, is dependent more upon selection of parents by the breeder than upon the education received by the foal from the trainer.

ZOOLOGY.

Weed's Life Histories of American Insects.[3] — This little work is evidently intended to meet in part the need of popular handbooks of nature study, and it does it in an admirable manner. It consists

[1] Francis Galton, *Natural Inheritance.*

[2] Galton, *loc. cit.*

[3] *Life Histories of American Insects*, by Clarence Moores Weed. New York, The Macmillan Company. 8vo, 272 pp., with illustrations. $1.50.